Health Canada Santé Canada

Your health and safety... our priority. *Votre santé et votre sécurité... notre priorité.*

Proposed Re-evaluation Decision PRVD2017-12

Hydrogen Peroxide and Its Associated End-use Products

Consultation Document

(publié aussi en français)

31 August 2017

This document is published by the Health Canada Pest Management Regulatory Agency. For further information, please contact:

Publications
Pest Management Regulatory Agency
Health Canada
2720 Riverside Drive
A.L. 6607 D
Ottawa, Ontario K1A 0K9

Internet: pmra.publications@hc-sc.gc.ca

Facsimile: 613-736-3758
Information Service:
1-800-267-6315 or 613-736-3799
pmra.infoserv@hc-sc.gc.ca

Canada

ISSN: 1925-0959 (print)
1925-0967 (online)

Catalogue number: H113-27/2017-12E (print)
H113-27/2017-12E-PDF (PDF version)

© Her Majesty the Queen in Right of Canada, represented by the Minister of Health Canada, 2017

All rights reserved. No part of this information (publication or product) may be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, or stored in a retrieval system, without prior written permission of the Minister of Public Works and Government Services Canada, Ottawa, Ontario K1A 0S5.

Table of Contents

Overview 1
What is the Proposed Re-evaluation Decision? 1
What Does Health Canada Consider When Making a Re-evaluation Decision? 1
What is Hydrogen Peroxide? 1
Health Considerations 2
Environmental Considerations 3
Measures to Minimize Risk 4
What Additional Scientific Information is Required? 4
Next Steps 5
Science Evaluation 7
1.0 Introduction 7
2.0 Use Description of Hydrogen Peroxide 7
3.0 The Technical Grade Active Ingredient and Its Properties 8
3.1 Identity of the Technical Grade Active Ingredient 8
3.2 Physical and Chemical Properties of the Technical Grade Active Ingredient 9
4.0 Human Health 9
4.1 Toxicological Summary 9
4.2 Occupational Exposure 10
4.2.1 Mixer/Loader/Applicator Exposure and Risk 10
4.2.2 Postapplication Exposure and Risk 13
4.3 Non-occupational Exposure 15
4.3.1 Residential Exposure and Risk 15
4.3.2 Dietary Exposure and Risk 16
4.4 Aggregate Exposure and Risk Assessment 16
4.5 Cumulative Exposure and Risk 17
5.0 Environment 17
5.1 Environmental Fate and Toxicology 17
5.2 Environmental Exposure and Risk Assessment 18
5.2.1 Aquaculture uses 18
5.2.2 Agricultural uses 18
5.2.3 Industrial uses 19
6.0 Value 19
7.0 Pest Control Product Policy Considerations 19
7.1 Toxic Substances Management Policy Considerations 19
8.0 Incident Reports (TBC) 20
9.0 Organisation for Economic Co-operation and Development Status of Hydrogen Peroxide 20
10.0 Proposed Re-evaluation Decision 20
List of Abbreviations 21
Appendix I Registered Hydrogen Peroxide Products as of 15 May 2017 23
Appendix II Label Amendments for Products Containing Hydrogen Peroxide 25
References 29

Overview

What is the Proposed Re-evaluation Decision?

After a re-evaluation of hydrogen peroxide as an algaecide, bactericide, fungicide, slimicide, sanitizer and acaricide, the Health Canada Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is proposing continued registration of products containing hydrogen peroxide for sale and use in Canada.

An evaluation of available scientific information found that products containing hydrogen peroxide do not present unacceptable risks to human health or the environment when used according to the proposed label directions. As a condition of the continued registration of hydrogen peroxide uses, new risk-reduction measures are proposed to be included on the labels of all products. This proposal affects all end-use products containing hydrogen peroxide registered in Canada.

This Proposed Re-evaluation Decision (PRVD) is a consultation document[1] that summarizes the science evaluation for hydrogen peroxide and presents the reasons for the proposed re-evaluation decision.

The information is presented in two parts. The Overview describes the regulatory process and key points of the evaluation, while the Science Evaluation provides additional information on the assessment of hydrogen peroxide.

The PMRA will accept written comments on this proposal up to 90 days from the date of publication of this document. Please forward all comments to Publications (see contact information on the cover page of this document).

What Does Health Canada Consider When Making a Re-evaluation Decision?

The PMRA pesticide re-evaluation program considers potential risks, as well as value, of pesticide products to ensure they meet modern standards established to protect human health and the environment.

What is Hydrogen Peroxide?

Hydrogen peroxide is used as an algaecide, bactericide, fungicide, slimicide, sanitizer and acaricide and has a broad use pattern including use in aquaculture, agriculture, industry and as a hard and soft surface sanitizer.

Hydrogen peroxide is used as a broadcast spray or foam to clean hard surfaces and equipment in greenhouses, direct injection to clean greenhouse irrigation, humidification and recycled water systems and to treat water used to irrigate greenhouse crops.

---

[1] "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

Applications of hydrogen peroxide to outdoor and greenhouse ornamental crops may be made through chemigation, mist, fog, foliar spray and as a drench to soil or media. Hydrogen peroxide is applied by direct injection into misting systems to control algae growth on plant propagation material (that is cuttings, seeds and bulbs). Applications to greenhouse tomatoes and turf are made as a foliar spray.

Hydrogen peroxide is also used as a storage treatment on root crops (potato and sweet potato) and is applied as a spray treatment or is directly injected into humidification water. It is also added to wash water or as a fog to harvested fruits and vegetables.

As a slimicide, hydrogen peroxide is co-formulated with peroxyacetic acid to control microorganisms in pulp and paper mill systems, recirculating cooling water systems, on-shore oilfield and gas-field well operations as well as wastewater and sewage treatment systems.

Hydrogen peroxide is also registered as ready-to-use domestic and commercial class sanitizers on hard and/or soft surfaces.

As an acaricide, hydrogen peroxide used to control sea lice on Atlantic salmon. It is added to the water contained in wellboats (boats that contain large reservoirs to house fish), or to the water contained within completely enclosed tarpaulins in marine aquatic sites.

Health Considerations

Can Approved Uses of Hydrogen Peroxide Affect Human Health?

Hydrogen peroxide is unlikely to affect your health when used according to the label directions.

Potential exposure to hydrogen peroxide may occur by applying the end-use product, entering treated sites, or consuming food and water. The PMRA considers two key factors when assessing health risks: the levels at which no health effects occur and the levels to which people may be exposed. The levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers). As such, sex and gender are taken into account in the risk assessment. Continued registration is only supported for uses that are determined as having no health risks of concern.

Toxicology studies in laboratory animals describe potential health effects resulting from various levels of exposure to a chemical and identify dose levels at which no effects are observed.

Hydrogen peroxide is highly acutely toxic by the oral route, slightly toxic by the dermal route, and moderately toxic by the inhalation route of exposure. Technical Grade Active Ingredient hydrogen peroxide is considered to be corrosive to the skin and severely irritating or corrosive to the eyes, but it is not expected to be a skin sensitizer.

Available information on short-term and long-term (lifetime) animal toxicity tests were assessed for the potential of hydrogen peroxide to cause neurotoxicity, immunotoxicity, chronic toxicity, cancer, reproductive and developmental toxicity, genetic damage, and various other effects. There are no reports indicating short- or long-term effects resulting from hydrogen peroxide's

long history of use as a commodity chemical and a pesticide. This is to be expected from hydrogen peroxide's inability to accumulate in animal tissues due to its rapid decomposition to simple water and oxygen.

Risks in Residential and Other Non-Occupational Environments

Estimated risk for residential and other non-occupational exposure is not of concern.

Residential exposure to hydrogen peroxide can occur through application and by handling treated surfaces. Risk from residential exposure is not of concern under the current conditions of use.

Occupational Risks From Handling Products Containing Hydrogen Peroxide

Occupational risks are not of concern when products containing hydrogen peroxide are used according to the label directions, which include protective measures.

For the assessment of occupational exposure and risks, emphasis has been placed on hydrogen peroxide's potential acute toxicity.

Risk from occupational exposures to workers mixing, loading and applying hydrogen peroxide as well as to workers re-entering treated sites, are not of concern under current conditions of use for all uses.

Exposure to bystanders is expected based upon the registered use patterns and is not expected to be of concern.

Residues in Water and Food

Dietary risks from food and water are not of concern.

Risk from dietary exposure through consumption of food commodities and drinking water is not of concern under the current conditions of use. Based on the registered use patterns of hydrogen peroxide, dietary exposure (food + water) is expected to be negligible. Moreover, considering its long history of use as a commodity chemical, its natural occurrence in animal cells, and rapid decomposition in the environment as well as in animals, dietary exposure to hydrogen peroxide residues from use as a pesticide, however unlikely, is not of concern for all populations.

Environmental Considerations

What Happens When Hydrogen Peroxide is Introduced into the Environment?

Hydrogen peroxide is not expected to pose risks of concern to the environment when used according to the proposed label directions.

Hydrogen peroxide enters the environment following application, clean-up or discharge of effluent.

Based on the use pattern, environmental release of hydrogen peroxide from post-harvest treatment of fruits and vegetables, use in greenhouses and industrial uses (such as wastewater and sewage effluent or oil and gas fields) is expected to be minimal. Risk from the discharge of effluent water is also not expected to be of concern.

Hydrogen peroxide breaks down quickly in natural soils and natural aquatic environments and is not expected to build-up in soil and water. Hydrogen peroxide is not expected to be mobile in soil and has low potential to move through the soil and reach groundwater. Volatilization and long-range transport are also not expected. Hydrogen peroxide is not expected to accumulate in the tissues of organisms.

For use in aquaculture, hydrogen peroxide may pose a short-term risk to marine algae located close to the treated area. Due to the rapid reproduction rates of algae species coupled with the introduction of new algae populations by tidal flushing, hydrogen peroxide is not expected to pose a risk to algae populations. Hydrogen peroxide is not expected to pose a risk to other non-target marine organisms.

Terrestrial vascular plants can be exposed to hydrogen peroxide from drift following application to turf and outdoor ornamentals. Risk to terrestrial habitats is however not expected to be of concern.

Exposure of aquatic organisms to hydrogen peroxide may also occur following application to turf and outdoor ornamentals. A potential risk of concern from spray drift to off-target sensitive habitats was identified. As a result, buffer zones of 1 to 5 m are proposed to protect aquatic habitats.

Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human health and the environment. These directions must be followed by law. As a result of the re-evaluation of hydrogen peroxide, the PMRA is proposing further risk-reduction measures related to human health and the environment for product labels.

Human Health

- Additional precautionary label statement to minimize bystander exposure from spray drift

Environment

- Buffer zone to protect non-target aquatic organisms
- Environmental Precautions and Directions for Use label statements

What Additional Scientific Information is Required?

No additional data are required.

Next Steps

Before making a final re-evaluation decision on hydrogen peroxide, the PMRA will consider any comments received from the public in response to this consultation document. A science-based approach will be applied in making a final decision on hydrogen peroxide. The PMRA will then publish a Re-evaluation Decision[2] that will include the decision, the reasons for it, a summary of comments received on the proposed decision and the PMRA response to these comments.

[2] "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

Science Evaluation

1.0 Introduction

Following the re-evaluation announcement for hydrogen peroxide, the registrant of the technical grade active ingredients in Canada indicated that they intended to provide continued support for all uses included on the labels. Currently registered products containing hydrogen peroxide are listed in Appendix I.

2.0 Use Description of Hydrogen Peroxide

Hydrogen peroxide is used as an algaecide, bacteriacide, fungicide, slimicide and as an acaricide (for treatment of sea lice on Atlantic salmon). Hydrogen peroxide denatures proteins and enzymes, and increases cell wall permeability. This results in a disruption of cellular respiration and cell death.

Hydrogen peroxide is used as an algaecide, fungicide and crop bactericide in a number of ways. These include as a broadcast spray or foam to clean hard surfaces and equipment in greenhouses, direct injection to clean greenhouse irrigation, humidification and recycled water systems and to treat water used to irrigate greenhouse ornamental crops.

Applications of hydrogen peroxide to outdoor and greenhouse ornamental crops may be made through chemigation, mist, fog, foliar sprays (backpack sprayer, hand wand sprayer or boom sprayer) and as a drench to soil or media. Hydrogen peroxide is applied by direct injection into misting systems to control algae growth on ornamental plant propagation material (that is cuttings, seeds and bulbs). Applications to greenhouse tomatoes and turf are made as a foliar spray.

Hydrogen peroxide is also used as a post-harvest storage treatment on root crops (potato and sweet potato) and is applied as a spray treatment or is directly injected into water used to increase the humidity of stored root vegetables. It is also added to wash water or as a fog to harvested fruits and vegetables.

As an acaricide, hydrogen peroxide is used to control sea lice on Atlantic salmon. It is added to the water contained within wellboats (boats that contain large reservoirs to house fish), or to the water contained within completely enclosed tarpaulins in marine aquatic sites.

When used as a slimicide in pulp and paper mills, recirculating cooling water systems, oilfield and gas-field well operations, or sewage wastewater treatment plants it is applied using closed transfer systems.

Finally, as a sanitizer, hydrogen peroxide is applied as a ready-to-use product with a spray applicator attached. The domestic class end-use products is applied to soft surfaces, such as fabric and carpets. The commercial class end-use product is used on hard or soft surfaces in residential, and public areas including, food processing, institutional or industrial settings.

3.0 The Technical Grade Active Ingredient and Its Properties

3.1 Identity of the Technical Grade Active Ingredient

Common name		Hydrogen peroxide
Function		Acaricide, algaecide, bactericide, fungicide, slimicide, sanitizer
Chemical Family		Inorganic peroxide
Chemical name		
1	**International Union of Pure and Applied Chemistry (IUPAC)**	Hydrogen peroxide
2	**Chemical Abstracts Service (CAS)**	Hydrogen peroxide
CAS Registry Number		7722-84-1
Molecular Formula		H_2O_2
Molecular Weight		34.014

Purity of the Technical Grade Active Ingredient

Registration No.	Purity of the TGAI
27431	70%
31391	70%
31708	70%
31776	70.5%
27431	70%

3.2 Physical and Chemical Properties of the Technical Grade Active Ingredient

Property	Result
Vapour pressure	0.1 to 0.91 kPa
Ultraviolet (UV) / visible spectrum	Not expected to absorb at λ >300 nm
Solubility in water	Completely soluble
n-Octanol/water partition coefficient	Log K_{ow} = -0.70 to -1.57
Dissociation constant	pK_a = 11.62

4.0 Human Health

Exposure to hydrogen peroxide may occur through consuming food and drinking water, while working as a mixer/loader/applicator, while applying ready-to-use products or by entering into treated sites or handling paper.

The primary toxicology hazard for hydrogen peroxide is considered to be acute in nature, related to the corrosive properties to the eyes, skin and mucous membranes. A qualitative approach was taken for the assessment and mitigation of human health exposure and risk. No toxicological endpoints (for example, dermal, inhalation, dietary) for use in quantitative risk assessment have been identified for hydrogen peroxide.

4.1 Toxicological Summary

The toxicological database for hydrogen peroxide, consisting of waiver rationales and published data, is considered of sufficient completeness and scientific quality to define the potential toxic effects associated with hydrogen peroxide.

Hydrogen peroxide occurs naturally in the cells of humans and other species. The compound is readily absorbed across biological membranes and once it is absorbed, hydrogen peroxide undergoes spontaneous or enzyme-catalysed decomposition into oxygen and water. As a result, the overall absorption, distribution, metabolism, and excretion of intact hydrogen peroxide in humans and mammals is negligible.

Hydrogen peroxide is considered to be highly acutely toxic via the oral route, slightly toxic via the dermal route, and of moderate acute toxicity via inhalation. Technical Grade Active Ingredient hydrogen peroxide is considered to be corrosive to the skin and severely irritating or corrosive to the eyes, but it is not expected to be a skin sensitizer.

Based on available information and the long history of use of the compound as a commodity chemical and a pesticide, and the inability of the compound to accumulate in tissues due to its rapid decomposition, it is unlikely that hydrogen peroxide will induce developmental toxicity following maternal exposure or reproductive toxicity.

Hydrogen peroxide has been shown to be mutagenic in vitro, but is not genotoxic in vivo due to its rapid decomposition to water and oxygen.

There is limited evidence from experimental animals for the carcinogenicity of hydrogen peroxide based on studies in which duodenal tumours were reported following administration of the compound in drinking water to mice. However, the International Agency for Research on Cancer considers hydrogen peroxide to be not classifiable as to its carcinogenicity in humans because the evidence in animals is limited and inadequate in humans. Also, the United States Food and Drug Administration has concluded that there is no evidence that hydrogen peroxide is carcinogenic in foods treated with the compound during processing.

4.2 Occupational Exposure

Workers can be exposed to hydrogen peroxide through mixing, loading and applying hydrogen peroxide products or when re-entering treated sites or handling paper.

4.2.1 Mixer/Loader/Applicator Exposure and Risk

4.2.1.1 Aquaculture

Risk to workers mixing, loading and applying hydrogen peroxide in marine aquaculture sites was assessed. The assessment considered application in wells on a wellboat and in sea cages enclosed with tarpaulins. Potential routes of occupational exposure to hydrogen peroxide during treatment of salmon are dermal, ocular and inhalation.

Potential exposure during wellboat treatments is considered low as the wellboat is largely a closed system. Workers could however be exposed via splashing or vaporization if they are in the vicinity of the wells when hydrogen peroxide is delivered. The Personal Protective Equipment (PPE) currently required on the product label (that is chemical-resistant coveralls over single layer clothing, face shield, and chemical-resistant boots and gloves) is expected to mitigate dermal and ocular exposure. Potential inhalation exposure and risk for wellboat applications is expected to be minimal because hydrogen peroxide will rapidly be diluted with water during the application/mixing process and airborne concentrations above the wells are expected to be well below the American Conference of Governmental Industrial Hygienists time-weighted average threshold limit value (ACGIH TWA-TLV) of 1.4 mg/m^3 for hydrogen peroxide.

There is a greater potential for dermal, inhalation, and ocular exposures for workers applying hydrogen peroxide by the tarpaulin method, especially for those handling and operating the pumping system and distribution hoses for delivering the product to the sea cages. Potential dermal, inhalation and ocular exposure and risk is however expected to be mitigated by the PPE currently required on product labels (that is a NIOSH-approved respirator, chemical resistant coveralls over a long-sleeved shirt and long pants, face shield (when wearing a half face respirator), and chemical-resistant boots and gloves).

The storage tanks on the wellboat and on the barges used for the tarpaulin applications have breather vents to release any excess vapours of hydrogen peroxide. Inhalation exposures and risks from hydrogen peroxide vapours released from the storage tanks is expected to be negligible because: the tanks are vented to the ambient (sea) air; workers were not expected to be exposed to vapours released from the vents; and concentrations of hydrogen peroxide in the air above the vents are expected to be less than the ACGIH TWA-TLV.

Based on the above, risk to workers applying hydrogen peroxide on wellboats or in sea cages is not of concern under current conditions of use. No additional mitigation measures are proposed.

4.2.1.2 Agricultural uses

Workers can be exposed to hydrogen peroxide used in agricultural settings during mixing, loading and application. Exposure to workers occurs primarily by the dermal, inhalation and/or ocular routes.

Risk to workers handling hydrogen peroxide for use in agricultural settings (such as in greenhouses and/or outdoors) was assessed. The label of the end-use product registered for use in agricultural settings currently includes precautionary label statements and personal protective equipment requirements (that is face shield coveralls over a single layer boots chemical resistant gloves and NIOSH approved respiratory protection) to protect workers from potential dermal and inhalation exposures; Thus, under current conditions of use, risk to workers mixing, loading or applying hydrogen peroxide for agricultural uses is not of concern. No additional mitigation measures are proposed.

For post-harvest uses of hydrogen peroxide (such as, storage treatment on root crops), low occupational exposure is expected for spray treatments and applications into the humidification water during storage since the application equipment is automated and the system is essentially closed. The operator connects the lines to the application equipment and inserts the tubing into the product container. The product is automatically diluted with water and sprayed on the potatoes as they pass under a hood and along a conveyor belt. The potatoes then automatically fill the storage bins. There is potential for dermal and inhalation exposure while attaching and disconnecting the tubing from the product container, while levelling off the storage bins when full and from errant spray from the hooded conveyor belt. The wash water and fog tunnel application methods for post-harvest treatment on root crops are expected to result in higher handler exposure compared to the spray treatments and humidification water applications because greater amounts of hydrogen peroxide will be handled per day.

The label of the end-use product registered for post-harvest uses currently includes measures to mitigate dermal, inhalation and ocular exposure to hydrogen peroxide, such as PPE requirements during mixing, loading, application, clean-up and repair activities (such as, coveralls over single-layer clothing, chemical-resistant gloves, eye protection and a respirator) and precautionary label statements (such as advice on not breathing vapours, avoiding contact with skin, eyes, and clothing).

In addition, the product labels advise on keeping workplace airborne hydrogen peroxide levels below local workplace exposure limits and using NIOSH-approved respiratory protection if the exposure limits are exceeded. On this basis, risk to workers applying hydrogen peroxide for post-harvest agricultural uses is not of concern under the current conditions of use. No additional mitigation measures are proposed.

4.2.1.3 Industrial uses

The industrial uses of hydrogen peroxide include use in pulp and paper mills, recirculating cooling water systems, waste and sewage water treatment, and oilfield and gas-field well operations.

The potential for occupational exposure from the use of hydrogen peroxide in pulp and paper mills and re-circulating cooling systems is expected to be limited, and to occur when connecting or disconnecting the pump hoses to a tote, or in the case of a leak (that is a punctured tote or a leaking pump connection). To minimize potential acute exposure risk mitigation measures are included on the current labels such as PPE requirements (for example, goggles or face shield, coveralls, boots and chemical-resistant gloves when handling, and NIOSH-approved respiratory protection if certain exposure level are exceeded) and precautionary statements.

Occupational exposure to hydrogen peroxide used to treat wastewater and sewage effluent or oilfield and gas-field well operations can occur when the end-use product containers are connected to the manifold system, and is expected to be by the dermal or inhalation route, or through accidental splash to the eyes. Personal protective equipment (PPE) requirements on the end-use product labels instruct workers to wear goggles, face shield, protective coveralls, boots and chemical-resistant gloves while transferring and handling the product. In addition, precautionary statements instruct workers to ensure that air concentrations of hydrogen peroxide in the workplace do not exceed exposure levels established by Occupational Health and Safety Authorities in their jurisdiction, and that if values do exceed those levels, they are to wear NIOSH-approved respiratory protection. Other precautionary and hygiene statements on the end-use product label include instructions to not breathe the vapour, to not enter an enclosed area without proper respiratory protection, and to wash thoroughly with soap and water after handling. Worker exposure is expected to be appropriately mitigated through the above risk mitigation measures currently on the labels. No additional mitigation measures are proposed.

4.2.1.4 Sanitizer use

Occupational exposure to hydrogen peroxide from use of commercial class sanitizer products (1.4 to 2.2% hydrogen peroxide) is expected to be short-term and predominantly by the inhalation and dermal routes during application to hard or soft surfaces. The rapid decomposition of hydrogen peroxide into oxygen and water, which are not of toxicological concern, mitigates concern for residues once the product is applied or during the application.

Occupational exposure will be minimal if workers follow label recommendations. The label includes a number of exposure reduction statements (for example, avoid breathing spray mists) to protect workers against any unnecessary risk from exposure. The risk from exposure is not of concern due to the expected low toxicity of the end-use product and reduced occupational exposure when label directions are followed. No additional mitigation measure is proposed.

4.2.2 Postapplication Exposure and Risk

4.2.2.1 Aquaculture uses

Postapplication occupational dermal, inhalation or ocular exposure to hydrogen peroxide following application by the wellboat method is considered unlikely. The process of flushing the wells with fresh water will rapidly reduce the concentrations of hydrogen peroxide below treatment concentrations and the pump discharge of well water from the wellboat is expected to rapidly disperse any residual hydrogen peroxide into the sea. In addition, the product label requires workers involved in postapplication activities to wear personal protective equipment (that is chemical-resistant coveralls over single layer clothing, face shield, and chemical-resistant boots and gloves) to limit dermal and ocular exposures.

For tarpaulin applications, there is a potential for postapplication dermal, inhalation, and ocular exposures when the tarpaulins are removed to disperse the end-use product from the sea cages, empty storage tanks and hoses are rinsed out or divers enter the sea cages to remove dead fish after treatment. The product label requires workers involved in activities immediately after application to wear a NIOSH-approved respirator, chemical resistant coveralls over single-layer clothing, a face shield (when not wearing a full face respiratory protection), and chemical-resistant boots and gloves.

Under the current conditions of use, risk from occupational postapplication exposure to hydrogen peroxide used in aquaculture is not expected to be of concern.

4.2.2.2 Agricultural uses

There is potential for exposure to workers re-entering treated areas (such as fields, greenhouses and turf) through contact with the foliage of sprayed plants. Hydrogen peroxide is highly reactive and short-lived due to instability of the peroxide bond, which leads to rapid degradation after application. As such, residues are not expected to remain on crops after application of this product. Therefore, postapplication exposure to hydrogen peroxide was expected to be minimal, and risk is not of concern. To mitigate postapplication exposure the label of end use products registered for agricultural uses include a statement prohibiting entry into treated areas until residue has dried.

For post-harvest uses of hydrogen peroxide on fruit and vegetables, there is potential for occupational postapplication exposure when unloading and packing treated produce. These activities are performed after the produce is allowed to dry and any residues of hydrogen peroxide are likely to have decomposed.

For post-harvest uses of hydrogen peroxide on root vegetables there is also potential for occupational postapplication exposure when air levels of hydrogen peroxide are monitored (that is when monitoring test strips indicating the level of product in the air in storage areas are being checked).

The label of the end-use product registered for theses uses currently includes a precautionary statement advising against entering into treated areas until residues are dry. The label also instructs user to ensure that workplace airborne hydrogen peroxide levels are below local workplace exposure limits and to use respiratory protection if exposure limits are exceeded. The label also prohibits entry to treated storage bins until hydrogen peroxide air concentrations are below exposure levels established by occupational health and safety authorities in their jurisdiction. These measures were considered adequate to protect workers against acute hazards.

On this basis, risk from postapplication worker exposure to hydrogen peroxide is not expected to be of concern. No additional mitigation measures are proposed.

4.2.2.3 Industrial uses

Since recirculating cooling water systems are closed systems, and because hydrogen peroxide will dissipate rapidly from treated water and hot air from water cooling towers is discharged outdoors, occupational postapplication exposure to hydrogen peroxide is expected to be negligible.

The use of hydrogen peroxide in pulp and paper mills could result in postapplication exposure to workers handling paper; however, based on the rapid degradation of hydrogen peroxide in water, no residues are expected to be present in paper and postapplication exposure is expected to be negligible.

There is potential for exposure to hydrogen peroxide used as a sewage and wastewater effluent disinfectant in wastewater treatment plants or used in oilfield and gas-field well operations during post application activities such as removing the spent container from the manifold system, and coupling or uncoupling transfer lines. Worker exposure is expected to be appropriately mitigated through the required PPE, and observance of exposure levels and precautionary statements. The label of the registered end-use products include precautionary statements instructing workers to ensure that air concentrations of hydrogen peroxide in the workplace do not exceed exposure levels established by Occupational Health and Safety Authorities in their jurisdiction, and that if values do exceed those levels, they are to wear NIOSH-approved respiratory protection. Other precautionary statements on the end-use product label include instructions to not breathe the vapor and to not enter an enclosed area without proper respiratory protection.

Based on the above, risk from occupational postapplication exposure to hydrogen peroxide used in industrial settings is not expected to be of concern under current conditions of use. No additional mitigation measures are proposed.

4.2.2.4 Sanitizer use

Occupational postapplication exposure can occur when workers enter a treated area soon after the application. The primary exposure routes for re-entry workers are dermal from contact with freshly treated surfaces. To prevent exposure of people entering freshly treated areas, the proposed label has a restricted-entry statement to restrict entry into treated areas until the spray is dried. Postapplication exposure is considered to be minimal and not of concern under current conditions of use. No additional mitigation measure is proposed.

4.3 Non-occupational Exposure

4.3.1 Residential and Bystander Exposure and Risk

There are two domestic class hydrogen peroxide end-use products containing 0.5% hydrogen peroxide registered in Canada. They are registered for use as a ready-to-use sanitizer for non-food contact soft surfaces (including carpets). The trigger spray applicator provided with the product minimizes the aerosolization of the liquid and is expected to mitigate handler exposure. Two ready-to-use commercial class product containing 1.4 to 2.2% hydrogen peroxide are also registered for use on hard and soft surfaces.

Upon application, hydrogen peroxide rapidly decomposes into oxygen and water, which are not of toxicological concern. The lack of any residues of toxicological concern and the very low concentration of hydrogen peroxide in solution minimizes any concern for exposure to residual levels that may be present postapplication to hard or soft surfaces in residential, institutional or other public settings (for example, hospitals). On this basis, residential risk is not expected to be of concern.

Commercial and restricted class products containing hydrogen peroxide used in aquaculture, on turf, outdoor ornamentals, or in garden centres can also result in residential or bystander exposure. No residential or bystander exposure is expected to result from industrial uses or from greenhouse or post-harvest agricultural uses.

Under current conditions of use, risk from residential exposure from the use of hydrogen peroxide in aquaculture is not expected to be of concern. While recreational uses of the waters in the vicinity of fish farms treated with hydrogen peroxide can occur, it is expected that recreational boaters or fishermen would only be allowed to enter farm sites with permission from the farm owner and not when sea cages are being treated. The product label currently includes recommendations to that effect.

There is potential for residential postapplication exposure when re-entering garden centers, golf courses and residential areas treated with hydrogen peroxide. Exposure to residues of hydrogen peroxide on ornamentals and turf is expected to be minimal due to rapid degradation of hydrogen peroxide after application and mitigation through labelling preventing entry of unprotected persons into the treated areas until residues have dried. On this basis, risk from residential exposure is not expected to be of concern for these uses.

The use of hydrogen peroxide on turf and outdoor ornamentals can also result in potential bystander exposure through spray drift. The label of the end-use product currently includes a spray drift advisory label statement to protect bystanders. To meet current labelling standards, an updated spray drift label statement is proposed to be added to the product label (see Appendix II).

4.3.2 Dietary Exposure and Risk

Dietary exposure to hydrogen peroxide from food consumption can result from its use on greenhouse tomato, harvested fruits and vegetables, stored and sweet potatoes as well as its use in aquaculture. There is also potential for non-direct food contact from the registered use in pulp and paper mill systems.

Since hydrogen peroxide readily decomposes to oxygen and water upon contact with moisture in the environment or via enzyme catalysed processes in plants, residues of hydrogen peroxide on or in treated fruits and vegetables are expected to be negligible, and no metabolites of concern are expected to be formed. Thus, the use of hydrogen peroxide on harvested or stored fruits and vegetables is not expected to result in any residues that could pose a dietary risk.

Dietary exposure to hydrogen peroxide may occur through consumption of treated salmon; however, dietary risk is not expected to be of concern. Use of hydrogen peroxide for the treatment of sea lice in farmed salmon is not expected to result in increased levels of hydrogen peroxide over endogenous levels in the edible tissues of the treated fish due to rapid decomposition in the water as well as in the tissues. As the end-use is to be applied in sea cages or in wellboats in the sea, and due to the rapid decomposition of hydrogen peroxide in water, exposure to hydrogen peroxide in drinking water is expected to be minimal. On this basis, risk from dietary exposure to hydrogen peroxide from food and drinking water is not expected to be of concern under current conditions of use.

Dietary exposure to hydrogen peroxide may also occur from its use in pulp and paper mill systems since the product labels allow use in the manufacture of paper intended for food contact. Based on the rapid degradation of hydrogen peroxide, no residues are expected to be present in paper. As a result risk from dietary exposure is not of concern.

4.4 Aggregate Exposure and Risk

Aggregate exposure is the total exposure to a single pesticide that may occur from food, drinking water, residential and other non-occupational sources as well as from all known or plausible exposure routes (oral, dermal and inhalation). Acute and chronic aggregate risk assessments are comprised of contributions from food and drinking water exposures. Short-term and intermediate-term aggregate risk assessments are comprised of contributions from food, drinking water and non-occupational exposure (dermal, inhalation).

Since hydrogen peroxide rapidly degrades into water and oxygen, acute and chronic aggregate exposure from food and drinking water is expected to be minimal (see Section 4.3.2). In addition, as discussed in Section 4.3.1, residential exposure to hydrogen peroxide is expected to be limited. As dietary and residential exposures are not expected to result in risk of concern, the risk from short and intermediate term aggregate exposure to hydrogen peroxide is also not expected to be of concern for currently registered uses.

4.5 Cumulative Exposure and Risk

The *Pest Control Products Act* requires that the PMRA consider the cumulative exposure to pesticides with a common mechanism of toxicity. For the current re-evaluation, the PMRA did not identify information indicating that hydrogen peroxide shares a common mechanism of toxicity with other pest control products. Therefore there is no requirement for a cumulative assessment at this time.

4.6 Maximum Residue Limits

The *Food and Drug Act* prohibits the sale of adulterated food; that is, food containing a pesticide residue that exceeds the established maximum residue limit (MRL). Pesticide MRLs are established for *Food and Drugs Act* purposes through the evaluation of scientific data under the *Pest Control Products Act*. Each MRL value defines the maximum concentration in parts per million (ppm) of a pesticide allowed in or on certain foods. Food containing a pesticide residue that is at or below the established MRL does not pose an unacceptable health risk.

No Canadian MRLs have been specified for hydrogen peroxide because of its relatively low toxicity, rapid degradation in the environment, and negligible potential for direct dietary exposure to consumers. However, for all agricultural and aquaculture commodities, including those registered for use in Canada but without a specific MRL, residues must not exceed 0.1 ppm as per Subsection B.15.002(1) of the Food and Drug Regulations.

5.0 Environment

5.1 Environmental Fate and Toxicology

Hydrogen peroxide is not persistent in natural soils or natural aquatic environments. Hydrogen peroxide is not expected to leach to groundwater. Volatilization and long-range transport are not expected. Accumulation and carry over are also not expected. Bioaccumulation is not expected.

Please refer to the Evaluation Report ERC2010-10, *Hydrogen Peroxide*, Proposed Registration Decision PRD2013-22, *Hydrogen Peroxide*, and Proposed Registration Decision PRD2014-11, *Hydrogen Peroxide* for environmental fate and ecological toxicology information for hydrogen peroxide.

5.2 Environmental Exposure and Risk Assessment

Environmental exposure and risk was assessed previously for the use of hydrogen peroxide for aquaculture, agriculture, industrial uses, sanitizer, post-harvest storage treatment on root crops. Environmental exposure is expected to be minimal and risk are expected to be minimal when hydrogen peroxide is used indoors as a sanitizer, as a post-harvest storage treatment on root crops and for use is greenhouses.

5.2.1 Aquaculture uses

Please refer to the Proposed Registration Decision PRD2014-11 for information on environmental exposure and risk assessment for the use of hydrogen peroxide for aquaculture.

Hydrogen peroxide enters the environment when applied to treat sea lice on farmed salmon. The product can be applied directly into net pens in open water or into wellboats containing salmon. Hydrogen peroxide is highly reactive in natural waters and breaks down rapidly to form water and oxygen. It is not expected to accumulate over time in either sediment or in the water column. Hydrogen peroxide dissolves easily in water and is unlikely to move into sediments. Hydrogen peroxide is not expected to enter the atmosphere or be subject to long-range transport. Hydrogen peroxide does not readily bind to organic matter and is not expected to accumulate in animals or plants.

When used according to label directions hydrogen peroxide is expected to pose a negligible risk to mammals, crustaceans, amphibians, birds, or fish. The use of hydrogen peroxide may pose a short term risk to marine algae located close to the treated aquaculture net pens and wellboat flushing pipes. Due to the rapid reproduction rates of algae species coupled with the introduction of new algae populations by tidal flushing, hydrogen peroxide is not expected to pose a risk to algae populations. Label statements are currently included on the product labels to inform the users of the potential risks.

Additional label statements are proposed to be included on the end-use product label to meet current labelling standards (please refer to Appendix II).

5.2.2 Agricultural uses

Please refer to the Evaluation Report ERC2010-10 and the Proposed Registration Decision PRD2013-22 for information on the environmental exposure and risk assessment for the use of hydrogen peroxide for agriculture.

Risk to terrestrial organisms is not expected to be of concern under current conditions of use. A potential risk of concern to aquatic organisms from spray drift to aquatic habitats was previously identified, and spray drift buffer zones are currently included on product labels. Buffer zones have been revised to meet current standards. As such, buffer zones of 1 to 5 m are proposed to protect aquatic habitats. Label amendments are proposed to meet current labelling standards. The proposed label amendments are listed in Appendix II.

5.2.3 Industrial uses

Environmental exposure and risk from the use of hydrogen peroxide in industrial settings (such as, recirculating cooling water systems, pulp and paper mills, waste water sewage treatment and on-shore oilfield and gas-field well operations) was previously assessed.

Exposure to terrestrial organisms from the use of hydrogen peroxide in recirculating cooling water systems, pulp and paper mills, and waste water and sewage treatment facilities is expected to be very limited. Risk from potential exposure to aquatic organisms from the discharge of effluents is not expected to be of concern under current conditions of use.

The use of hydrogen peroxide in on-shore oilfield and gas-field well operations could result in a potential exposure to terrestrial and aquatic habitats due to the discharge of spent treatment fluids during operations. Concentrations of hydrogen peroxide in waste fluids from use in oil and gas operations are expected to be low, as hydrogen peroxide breaks down quickly in aquatic and terrestrial environments, and residues are not expected to bioaccumulate in organisms. As such, hydrogen peroxide used in on-shore oil and gas field operations is not expected to pose a concern to the environment under current conditions of use.

Label statements are proposed to meet current labelling standards and further protect aquatic habitats. The proposed label amendments are listed in Appendix II.

6.0 Value

Hydrogen peroxide provides growers with an alternative mode of action to manage certain fungal and bacterial diseases, especially on ornamentals, where a limited number of fungicide products are currently registered. Its integration into a pest management program may contribute to the delay of resistance development in sensitive pathogens.

Hydrogen peroxide is important as a post-harvest application to fruits and vegetables to reduce the growth of both bacterial and fungal pathogens that cause post-harvest spoilage and decay. The alternative active ingredients for this use are registered on a limited number of crops and are disease specific (such as grey mould on apples).

Hydrogen peroxide is also of value for the treatment of municipal wastewater effluent.

7.0 Pest Control Product Policy Considerations

7.1 Toxic Substances Management Policy Considerations

Hydrogen peroxide was assessed in accordance with the PMRA Regulatory Directive DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*, and does not meet the Track 1 criteria. The active ingredient dissipates rapidly in the environment. It is not persistent and does not bioaccumulate.

8.0 Incident Reports

As of 30 May 2017, three Canadian incident reports involving hydrogen peroxide have been submitted to the PMRA. No human incidents were reported to the PMRA.

Two of the reported incidents involved farmed Atlantic salmon deaths that occurred during a bath treatment for sea lice with hydrogen peroxide. One of these incidents was considered to be related to the reported pesticide exposure. A delayed flushing of hydrogen peroxide from the well tank and exposure of fish to a treatment duration longer than that specified on the product label likely resulted in fish mortality. The second incident was likely due to factors other than the pesticide. The third incident report involved abnormal bee behaviour and a small number of dead bees, and was considered minor in nature.

Based on the low frequency and severity of incidents involving hydrogen peroxide, no additional risk mitigation measures are recommended. The incident report data are incorporated into the re-evaluation of hydrogen peroxide.

9.0 Organisation for Economic Co-operation and Development Status of Hydrogen Peroxide

Canada is part of the Organisation for Economic Co-operation and Development (OECD), which provides a forum in which governments can work together to share experience and seek solutions to common problems.

As part of the re-evaluation of an active ingredient, the PMRA takes into consideration recent developments and new information on the status of an active ingredient in other jurisdictions, including OECD member countries.

Hydrogen peroxide is currently acceptable for use in other OECD member countries, including Australia, the European Union Member States, New Zealand and the United States. As of 12 May 2017, no decision by an OECD member country to prohibit all uses of hydrogen peroxide for health or environmental reasons has been identified.

10.0 Proposed Re-evaluation Decision

The PMRA has determined that products containing hydrogen peroxide for sale and use in Canada are acceptable for continued registration provided that the label amendments described in Appendix II are implemented.

List of Abbreviations

ACGIH TWA-TLV	American Conference of Governmental Industrial Hygienists Time-Weighted Average Threshold Limit Value
CAS	Chemical Abstracts Service
DACO	Datacode
DIR	Regulatory Directive document
DNA	Deoxyribonucleic acid
EC_{50}	Effect Concentration
EEC	Estimated Environmental Concentration
g	gram(s)
Inc.	Incorporated
IUPAC	International Union of Pure and Applied Chemistry
K_{ow}	*n*-octanol–water partition coefficient
kPa	Kilo Pascal
L	Litre
LC_{50}	Lethal Concentration
LD_{50}	Lethal Dose
LLC	Limited Liability Company
LOC	Level of Concern
Ltd.	Limited
m^3	cubic meter
mg	milligram(s)
MRL	maximum residue limit
NIOSH	National Institute of Occupational Safety and Health
NOEC	No Observable Effect Concentration
NOL	No Objection Letter
OECD	Organization for Economic Co-operation and Development
p*K*a	dissociation constant
PMRA	Pest Management Regulatory Agency
PPE	Personal Protective Equipment
ppm	parts per million
PRVD	Proposed Re-evaluation Decision
RQ	Risk Quotient
TSMP	Toxic Substances Management Policy
ULC	Unlimited Liability Corporation
UV	ultraviolet

Appendix I Registered Hydrogen Peroxide Products as of 15 May 2017

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
32401	Commercial	Alpha Chemical Limited	Aquaparox 50	Solution	Hydrogen Peroxide 50.5%
31708	Technical Grade Active Ingredient	Arkema Inc.	Arkema M-70 Hydrogen Peroxide Technical		Hydrogen Peroxide 70%
31709	Manufacturing Concentrate		Arkema Peroxal 35 Bio		Hydrogen Peroxide 35%
31710			Arkema Peroxal 50 Bio		Hydrogen Peroxide 50%
27431	Technical Grade Active Ingredient	Biosafe Systems LLC	Biosafe M-70 Hydrogen Peroxide Technical Bactericide/Fungicide		Hydrogen Peroxide 70%
27432	Commercial		Storox		Hydrogen Peroxide 27%
29508			Zerotol Broad Spectrum Algaecide/Fungicide		Hydrogen Peroxide 27%
28826	Technical Grade Active Ingredient	Evonik Canada Inc.	Peraclean		Peroxyacetic acid 15% Hydrogen Peroxide 22%
31776			High Purity Grade 70% H_2O_2		Hydrogen Peroxide 70.5%
30066	Commercial	Kemira Chemicals Inc.	Fennosan PAA 15-C		Peroxyacetic acid 15% Hydrogen Peroxide 10%
26166	Commercial	Nalco Canada ULC	Nalco 7650 Pulp & Paper Microbiocide		Peroxyacetic acid 5.1% Hydrogen Peroxide 21.7%
26165	Technical Grade Active Ingredient	Peroxychem LLC	Vigorox SP Paper System Biocide		Peroxyacetic acid 5.1% Hydrogen Peroxide 21.7%
26978			Vigorox SP-15 Paper System Biocide		Peroxyacetic acid 15% Hydrogen Peroxide 10%

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
31329	Technical Grade Active Ingredient	Peroxychem LLC	Vigorox 15/23 Antimicrobial Agent	Solution	Peroxyacetic acid 15% Hydrogen Peroxide 23%
31330	Commercial		Vigorox WWT II		
32715			Vigorox Oil& Gas		Peroxyacetic acid 10% Hydrogen Peroxide 15%
30675	Technical Grade Active Ingredient	Solvay Chemicals Inc.	Proxitane		Peroxyacetic acid 12% Hydrogen Peroxide 20%
30676	Commercial		Proxitane WW-12		
31391	Technical Grade Active Ingredient		Interox® M-70 Hydrogen Peroxide		Hydrogen Peroxide 70%
31392	Manufacturing Concentrate		Interox® CPMC-50		Hydrogen Peroxide 50%
31393	Restricted		Interox® Paramove® 50		
32403	Commercial	The Clorox Company Ltd.	Clorox Healthcare® Hydrogen Peroxide Cleaner Disinfectant		Hydrogen Peroxide 1.4%
32468	Commercial	The Clorox Company Ltd	Clorox Commercial Solutions Clorox® Disinfecting Urine Remove		Hydrogen Peroxide 2.2%
32527	Domestic	Virox Technologies Inc.	Bissell Pet Pretreatment + Sanitize		Hydrogen Peroxide 0.5%
32192	Domestic	Virox Technologies Inc.	Bissel Deep Clean + Sanitize		Hydrogen Peroxide 0.5%

Appendix II Label Amendments for Products Containing Hydrogen Peroxide

The label amendments presented below do not include all label requirements for individual end-use products, such as first aid statements, disposal statements, precautionary statements and supplementary protective equipment. Information on labels of currently registered products should not be removed unless it contradicts the label statements provided below.

A submission to request label revisions will be required within 90 days of finalization of the re-evaluation decision.

I) For products registered for use on outdoor ornamentals and turf, under **PRECAUTIONS**, the following statements must be added:

> Apply only when the potential for drift to areas of human habitation or areas of human activity such as houses, cottages, schools and recreational areas is minimal. Take into consideration wind speed, wind direction, temperature inversions, application equipment and sprayer settings.

II) For products used in aquaculture add the following text to **USE RESTRICTIONS:**

> This product is to be used only in the manner authorized; consult provincial pesticide regulatory authorities about use permits that may be required.
>
> The restricted uses of (product name) may be subject to other legislative requirements such as those under the *Fisheries Act*.

For all products (excluding those registered for use on outdoor ornamentals and turf) add to **ENVIRONMENTAL PRECAUTIONS:**

> TOXIC to aquatic organisms.

III) For products registered for use on outdoor ornamentals and turf add the following text to **ENVIRONMENTAL PRECAUTIONS:**

> TOXIC to aquatic organisms. Observe buffer zones specified under DIRECTIONS FOR USE.
>
> To reduce runoff from treated areas into aquatic habitats avoid application to areas with a moderate to steep slope, compacted soil, or clay.
>
> Avoid application when heavy rain is forecast.
>
> Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative strip between the treated area and the edge of the water body.

IV) For products registered for use on greenhouse tomatoes, remove the following text under **ENVIRONMENTAL PRECAUTIONS**:

> "This product may be highly toxic to bees and other beneficial insects exposed to direct contact. Do not apply this product or allow it to drift onto tomatoes while bees are actively visiting the treatment area."

and replace with:

> "Greenhouse use: Toxic to bees and other beneficial insects. May harm bees and other beneficial insects, including those used in greenhouse production. Do not apply when bees or other beneficial insects are foraging in the treatment area."

V) For products registered for use on outdoor ornamentals and turf, add the following text to the **DIRECTIONS FOR USE**:

> Field sprayer application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE S572.1) medium classification. Boom height must be 60 cm or less above the crop or ground.
>
> Airblast application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** direct spray above plants to be treated. Turn off outward pointing nozzles at row ends and outer rows. **DO NOT** apply when wind speed is greater than 16 km/h at the application site as measured outside of the treatment area on the upwind side.
>
> Chemigation: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE S572.1) medium classification. Applications **MUST** be conducted **WITHOUT** the use of end guns.
>
> **DO NOT** apply by air.

Buffer zones:

Spot treatments using hand-held equipment **DO NOT** require a buffer zone. Soil drench or soil incorporation **DO NOT** require a buffer zone.

> The buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands) and estuarine/marine habitats.

Method of application	Crop		Buffer Zones (metres) Required for the Protection of:			
			Freshwater Habitat of Depths:		Estuarine/Marine Habitats of Depths:	
			Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m
Field sprayer or chemigation sprayer	Ornamentals		1	0	1	1
	Turf		1	1	1	1
Airblast	Ornamental Trees	Early growth stage	5	0	4	1
		Late growth stage	3	0	2	1

For tank mixes, consult the labels of the tank-mix partners and observe the largest (most restrictive) buffer zone of the products involved in the tank mixture and apply using the coarsest spray (ASAE) category indicated on the labels for those tank mix partners.

The buffer zones for this product can be modified based on weather conditions and spray equipment configuration by accessing the Buffer Zone Calculator on the Pest Management Regulatory Agency web site.

VI) For products registered for use in pulp and paper mills, recirculating water systems, sewage and waste water treatment and on-shore oilfield and gas-field well operations the following statement must be included in a section entitled **DIRECTION FOR USE:**

DO NOT discharge effluent containing this product or the biocide produced into sewer systems, lakes, streams, ponds, estuaries, oceans or other waters unless the effluent has been detoxified by suitable means.

VII) For products registered for use in greenhouses, the following statement must be included in a section entitled **ENVIRONMENTAL PRECAUTIONS:**

DO NOT allow effluent or runoff from greenhouses containing this product to enter lakes, streams, ponds or other waters.

VIII) The following text must be included under **DIRECTIONS FOR USE** on all product labels, except on products registered for controlling sea lice and ready-to-use products:

As this product is not registered for the control of pests in aquatic systems, DO NOT use to control aquatic pests.

DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

IX) For products co-formulated with peroxyacetic acid, the following statements must be included in a section entitled **DISPOSAL:**

For returnable containers:

DO NOT reuse this container for any purpose. For disposal, this empty container may be returned to the point of purchase (distributor/dealer).

For containers that can be refilled for the user by the distributor/dealer:

For disposal, this container may be returned to the point of purchase (distributor/dealer). It must be refilled by the distributor/dealer with the same product. Do not reuse this container for any other purpose.

Disposal of unused, unwanted product:

For information on disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Contact the manufacturer and the provincial regulatory agency in case of a spill, and for clean-up of spills.

For non-returnable non-recyclable or non-refillable containers:

Triple- or pressure-rinse the empty container. Add the rinsings to the spray mixture in the tank.

Follow provincial instruction for any required additional cleaning of the container prior to its disposal.

Make the empty container unsuitable for further use.

Dispose of the container in accordance with provincial requirements.

For information on disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Contact the manufacturer and the provincial regulatory agency in case of a spill, and for clean-up of spills.

References

A. LIST OF STUDIES/INFORMATION SUBMITTED BY THE REGISTRANT

Unpublished Information

PMRA Document Number	Reference
2680161	2016. Evaluation Report for Category B, Subcategory B.2.1,B.2.3,B.2.4,B.3.12,B.3.4 Application
2675829	2016 Note to file
1384171	2000, Waiver for Not Submitting Chemical and Physical Property Protocols and Certain Studies, DACO: 2.14.1,2.14.10,2.14.11,2.14.12,2.14.13,2.14.2,2.14.3,2.14.4,2.14.5,2.14.6, 2.14.7,2.14.8,2.14.9,2.15 CBI
2318286	2013, DACO 2.11.2 Description of the Starting Materials, DACO: 2.11.2 CBI
2318289	2013, Albone 70% MS: Preliminary analysis and Enforcement Analytical Method, DACO: 2.13.1,2.13.2,2.13.3 CBI
2318290	2001, Albone 70% MS: Product Chemical Identity, Manufacturing Process and Impurities Data, DACO: 2.11.1,2.11.2,2.11.3,2.11.4,2.13.1 CBI
2420404	[CBI Removed], 2014, THE MANUFACTURE OF HYDROGEN PEROXIDE, DACO: 2.11.3 CBI
2420405	2013, [CBI Removed] analysis Albone M-70-2013-FI-FI20130912145600-A-00126142-05176[1], DACO: 2.13.4 CBI
2420406	2012, [CBI Removed] analysis Albone M-70-2013-FI-FI20130912145600-A-00126142-05176[1], DACO: 2.13.4 CBI
2420407	2011, [CBI Removed] analysis Albone M-70-2013-FI-FI20130912145600-A-00126142-05176[1], DACO: 2.13.4 CBI
2296418	Discussion of Formulation of Impurities, DACO: 2.11.4 CBI
2296424	Batch Data, DACO: 2.13.3 CBI
2332045	2013, Description of Starting Materials with MSDSs (version 2), DACO: 2.11.2 CBI
2332046	2013, Detailed Production Process Description (Version 2), DACO: 2.11.3 CBI
2332051	2013, [CBI Removed] Waiver Request, DACO: 2.13.4 CBI
2369819	2013, Chemistry-2.11.2-10dec2013-M70-arkema, DACO: 2.11.2 CBI
2369822	2013, Albone 70% MS: Preliminary analysis and Enforcement Analytical Method, DACO: 2.13.1,2.13.2,2.13.3 CBI
2369823	2001, Albone 70% MS: Product Chemical Identity, Manufacturing Process and Impurities Data, DACO: 2.11.1,2.11.2,2.11.3,2.11.4,2.13.1 CBI
2440478	2001, ALBONE 70 MS (Hydrogen Peroxide): Product Chemical Identity, Formulating Process and Impurities Data, DACO: 2.11.1,2.11.3,2.11.4 CBI
2440488	[CBI Removed], 2014, THE MANUFACTURE OF HYDROGEN PEROXIDE, DACO: 2.11.3 CBI

2440491	2013, [CBI Removed] analysis Albone M-70-2013-FI-FI20130912145600-A-00126142-05176[1], DACO: 2.13.4 CBI
2440492	2012, [CBI Removed] analysis Albone M-70-2013-FI-FI20130912145600-A-00126142-05176[1], DACO: 2.13.4 CBI
2440493	2011, [CBI Removed] analysis Albone M-70-2013-FI-FI20130912145600-A-00126142-05176[1], DACO: 2.13.4 CBI
2410623	2014, Chemistry and Manufacturing, DACO: 2.1,2.11.1,2.11.2,2.11.3,2.11.4,2.12,2.12.1, 2.13.1,2.13.2,2.13.3,2.13.4,2.2,2.3,2.3.1,2.4,2.5,2.6,2.7,2.8,2.9 CBI
2410625	2014, CHEMINFO Chemical Profiles Created by CCOHS (Hydrogen Perioxide greater than 35%), DACO: 2.14.1,2.14.10,2.14.11,2.14.12,2.14.13,2.14.2,2.14.3,2.14.4,2.14.5,2.14.6, 2.14.7,2.14.8,2.14.9
2443241	2014, Impurites, DACO: 2.13.4 CBI
2495417	2015, Batch Data, DACO: 2.13.3 CBI
2495418	2015, Detailed Information on Starting Materials, DACO: 2.11.2 CBI
2500533	2015, Revised Manufacturing Summary, DACO: 2.11.1 CBI

B. ADDITIONAL INFORMATION CONSIDERED

Published Information

PMRA Document Number	Reference
2700241	2016. Evaluation Report for Category B, Subcategory 3.12 Application
2606013	2016. Evaluation Report for Category B, Subcategory 2.1, 2.3, 2.4, 3.4, 3.12, 3.14 Application
2494950	2015. Evaluation Report for Category B, Subcategory 3.11, 3.12 Application
2465221	2015. Evaluation Report for Category B, Subcategory 1.2 Application 2013-6882
2659491	2016. Registration Decision Hydrogen Peroxide RD2016-18
2409297	2014. Proposed Registration Decision Hydrogen Peroxide PRD2014-11
2396955	2014. Evaluation Report for Category A, Subcategory 2.0 Application
2375860	2014. Registration Decision Hydrogen Peroxide RD2014-19
2375858	2013. Proposed Registration Decision Hydrogen Peroxide PRD2013-22
2032552	2013. Evaluation Report for Category B, Subcategory 2.6 Application
2274834	2013. Registration Decision Hydrogen Peroxide RD2013-06
2248469	2012. Proposed Registration Decision Proxitane PRD2012-28
1871477	2010. Evaluation Report Hydrogen Peroxide ERC2010-10
1243749	2006. Proposed Regulatory Decision Document PRDD2006-02, BioSafe OxiDate Bactericide/Fungicide Potato Storage Treatment Containing Hydrogen Peroxide. 27 March 2006.